Comparing JitPro and Coq

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Introduction to Jitpro

JavaScript **I**nteractive Higher-Order **T**ableau **Pro**ver

- Simply typed
- Refutation calculus
- Built-in Classical Logic
- Propositions of type Bool
- Rule application by the click of a button

A small Example:

$$\forall A, B : \mathbb{B}. A \wedge B \longrightarrow B \wedge A$$

Introduction to Coq

- GALLINA specification language
- Calculus of Inductive Constructions
- Polymorphic
- Proofs in Coq similar to Proofs in ND
- Building proofs by applications of tactics

Introduction to Coq

- 3 basic sorts:
  - Prop
  - Set
  - Type
- Everything is a term
- Curry-Howard Isomorphism
- Proof checking by type checking

Automatization Features

- User-defined tactics
- Auto tactic
  - Hint databases
  - Add arbitrary theorems/tactics to database
  - Matches current goal with hint database

Almost the same small Example:

$$\forall A, B : Prop. A \wedge B \longrightarrow B \wedge A$$

Changing the order of quantifiers:

$$\forall P : A \longrightarrow A \longrightarrow \mathbb{B}.$$

$$(\exists x : A \, \forall y : A, P \, x \, y) \Rightarrow \forall y : A \, \exists x : A. P \, x \, y$$

Proof in JitPro ...

Changing the order of quantifiers (polymorphic):

$$\forall A : Type. \forall P : A \longrightarrow A \longrightarrow Prop.$$

$$(\exists x : A \, \forall y : A, P \, x \, y) \Rightarrow \forall y : A \, \exists x : A. P \, x \, y$$

Proof in Coq ...

Kaminski Equation

$$\forall f : \mathbb{B} \to \mathbb{B}.\ \forall x : \mathbb{B}.\ f\,(f\,(f\,x)) = f\,x$$

The Mating Rule

$$\frac{p\,x_1 \ldots x_n \qquad \neg p\,y_1 \ldots y_n}{x_1 \neq y_1 \mid \ldots \mid x_n \neq y_n}$$

The Mating Tactic

```
Theorem mating :
   forall (P:(bool -> bool)) (a b:bool),
      P a = true -> P b <> true->(a<>b).

Ltac t_mate f a b P1 P2 :=
   assert(a <> b);
   [exact (mating f a b P1 P2) | idtac].
```

Usability

- JitPro:
  - Checks rule applicability
  - Proof by clicking
- Coq:
  - Reusable proof scripts

Extendability and Automatization

- JitPro:
  - Native Javascript functions
- Coq:
  - Developing and proving in same environment
  - Guaranteed soundness


I. Bertot, P. Castéran, Interactive Theorem Proving and Program Development, Springer Verlag, 2004


The Coq Proof Assistant Reference Manual (http://coq.inria.fr/V8.1pl3/refman/index.html)


G. Smolka, C. E. Brown, Introduction to Computational Logic 2008 Lecture Notes (http://www.ps.uni-sb.de/courses/cl-ss08/script/icl.pdf)


G. Smolka, C. E. Brown, Terminating Tableaux for the Basic Fragment of Simple Type Theory, 2009

Thank You